

Journal of Endodontics, 1996, Vol. 22

MARCH

**Col. Schindler, Chairman Of Endodontics
59th MDW Dental Directorate
Lackland AFB, TX**

Articles:

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MARCH (Cont.)

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- **Subpontic hyperostosis**

Evaluation of a pulse oximeter and customized probe for pulp vitality testing

Kahan RS, Gulabivala K, Snook M, Setchell DJ. Evaluation of a pulse oximeter and customized probe for pulp vitality testing. J Endodon 1996;22:105-9.

PURPOSE: To design, build, and test an intraoral dental probe which would interface with a commercial pulse oximeter (PO).

M&M: The PO used was an Ohmeda Biox 3740, which displays oxygen saturation and pulse rate readings, in addition to a plethysmographic waveform. The prototype *reflectance tooth probe* had a head diameter of 4 mm, and consisted of detector fiberoptic light guides encircling a central core of emitter fibers. This was connected to the LED's from a stripped-down PO finger probe, which could be mounted to the F surface of a modified #212 rubber dam clamp. 20 unrestored, responsive anterior teeth from 10 volunteers were examined. Pulse waveforms were recorded and compared between each patient's finger, one maxillary central incisor, and one mandibular central incisor.

RESULTS: The average % of synchronization with the finger pulse was 16.9% for maxillary incisors, and 50.3% for mandibular incisors (significantly higher synchronicity).

C&C: The authors expressed disappointment in the low accuracy of this prototypical assembly to register a pulpal pulse. Several potential problem sources were identified, including: (1) the new probe concept may not be sensitive enough; (2) numerous sources of signal artifact still exist; and (3) we don't know if the teeth being evaluated had pulpal vitality. In its current form, this system is diagnostically unusable. In the future however, technology will (hopefully) prevail and afford us a reliable means of assessing pulpal blood flow.

March 1996

Christopher F. Bates

Effect of endodontic instrument handle diameter on operator performance

Chandler NP, Shaw JR, Treble SJ. Effect of endodontic instrument handle diameter on operator performance. J Endodon 1996;22:110-1.

PURPOSE: To determine whether diameter was an important factor in endodontic handle design.

M&M: Four metal 'keys' were fitted with 2.5, 3, 4, and 5 mm diameter acrylic handles. A simulator comprising typodont jaws in a chair-mounted head was used. The experiment involved removing a key from a combined holder / switch, which activated a timer, placing the key into an access cavity in tooth #3, which contained a lock mechanism. Once the lock was negotiated and the apex was reached, a microswitch stopped the timer. Thirty dental students were used, who wore polyvinyl gloves and made 4 timed attempts on the simulator for each of the 4 handle sizes. Four other readings were made using the 2.5 mm handle without gloves. Mean times were calculated for the 5 experimental groups.

RESULTS: The best times were recorded using the 5 mm handles, but this was not statistically significant. No significant difference was noticed in speed whether gloves were worn or not.

March 1996

Michael Hall

Evaluation of a dentin barrier test by cytotoxicity testing of various dental cements

Schmalz G, Schweikl H, Esch J, Hiller K-A. Evaluation of a dentin barrier test by cytotoxicity testing of various dental cements. J Endodon 1996;22:112-5.

PURPOSE: To evaluate a new cytotoxicity test system, by examining previously tested cell reactions toward certain dental cements.

M&M: Bovine dentin disks (500 µm thick) were etched on one side with 50% citric acid and pretreated either by autoclaving, or disinfecting with ethanol. Etched sides were seeded with L-929 mouse fibroblasts for 24 h, and the following test materials were placed on the opposite side of each disk on day 2: zinc phosphate (ZP) cement (2:1 and 1:1 P:L ratios), Ketac-Fil, Ketac-Silver, and Vitrebond. On day 3, the remaining viable cells were counted, and compared with controls.

RESULTS: In the autoclaved disks, ZP at both mixing ratios was the least toxic material tested, with the 1:1 blend yielding 40% survival, and the 2:1 allowing > 50% survival (significantly greater than 1:1). The two conventional glass ionomer (GI) cements were significantly more toxic than both ZP mixtures - Ketac-Fil reduced the cell number to 12%, and Ketac-Silver to 8%. Vitrebond, ZOE, and phenol killed all cells. Dentin disks which had received ethanol disinfection demonstrated a similar pattern, yet reduced levels of cellular toxicity for the ZP and GI's.

C&C: This experimental dentin barrier test probably did not duplicate the in vivo environment very well: (1) preparing the dentin likely alters its adsorption properties; (2) the static chamber does not reflect the effects of pulpal blood flow on solute concentration; and (3) moisture in the system may prevent the GI material from setting. These factors could explain the strong cytotoxic reactions evoked by the zinc oxide-eugenol and by the GI cements, in contrast to what is observed in vivo. The authors proposed that autoclaving dentin increased its diffusion rate, and that proteins were coagulated by ethanol treatment, which partly blocked dentin tubules.

March 1996

Christopher F. Bates

Electron microscopic study on interodontoblastic collagen fibrils in amputated canine dental pulps

Higashi T, Okamoto H. Electron microscopic study on interodontoblastic collagen fibrils in amputated canine dental pulps. J Endodon 1996;22:116-9.

PURPOSE: To determine the presence and structure of interodontoblastic collagen fibrils in reparative dentin following experimental pulpotomy.

M&M: 180 teeth from nine young adult dogs were used. Pulp exposures were made in the 2nd and 3rd incisors and the 1st, 2nd, and 3rd premolars of each jaw. The pulps were cleaned with 10% NaOCl and 3% H₂O₂ and dressed with an aqueous paste of Ca(OH)₂. The cavities were filled with ZOE and zinc phosphate and the animals were killed on the 7th, 14th, and 30th days after pulpotomy. The teeth were then prepared for histological study.

RESULTS: Preodontoblastic cells were seen on the 7th day, with numerous collagen fibrils between these cells. On the 14th d, the odontoblasts were further developed and distinct collagen fibril bundles were seen. On the 30th d, fully differentiated odontoblasts were present and collagen fibrils formed dense networks surrounding odontoblastic processes. Small fibril bundles resembling von Korff fibers were occasionally seen intercellularly and inserted into predentin.

C&C: The so-called von Korff fibers may function to support preodontoblastic cells in proper right angle alignment to the amputated pulp surface. Once the initial dentin layer is formed the interodontoblastic fibrils may no longer be necessary to support the odontoblasts, becoming thinner and fewer in number. However, Magloire et al. demonstrated that von Korff fibers do not develop in human pulp tissue, while Whittaker and Adams described their presence in developing human teeth. So apparently there is controversy regarding the existence of these fibrils during dentinogenesis, whether in primary or reparative dentin.

March 1996

Michael Hall

Histological findings of human leprosy periapical granulomas

Tani-Ishii N, Osada T, Watanabe Y, Umemoto T. Histological findings of human leprosy periapical granulomas. J Endodon 1996;22:120-2.

PURPOSE: To investigate the histological responses of *Mycobacterium leprae* in periapical human leprosy granulomas.

M&M: 12 periapical lesions from 12 lepers were obtained, fixed, embedded, sectioned, and stained for *M. leprae*. Sections were exposed to two monoclonal antibodies (specific for CD3 T-lymphocytes and CD22 B-lymphocytes). Biotinylated antimouse IgG was added and this was followed by counterstaining. Sections showing positive cell infiltration were examined by light microscopy, and the mean values of cell concentrations for 3 serial sections/case were determined.

RESULTS: All specimens were periapical granulomas. Langhans-type giant cells were present in 3 cases. Epithelioid cells had accumulated and formed tubercles in 4/12 cases; these have previously described histologically as leprosy granulomatous lesions. *M. leprae* was not observed in any of the 12 lesions by staining. Many T- and B-cells had infiltrated and surrounded the epithelioid cell tubercles and Langhans-type giant cells. The average T-/B-cell ratio was 2.0.

C&C: Despite the heavy infiltration, the T-/B-cell ratio of leprosy was not found to be changed from that of periapical granulomas of normal patients. The hallmark of granulomatous inflammation is the presence of epithelioid cells (transformed macrophages). Multinucleated giant cells form when foreign material is too large for a single macrophage to ingest. Each were found within these granulomas. Even though the organisms could not be seen, the authors believe their findings suggest the existence of *M. leprae* infection within periapical granulomas of lepers.

March 1996

Christopher F. Bates

An evaluation of the Canal Master, Balanced-Force, and Step-Back techniques

Hankins PJ, ElDeeb ME. An evaluation of the Canal Master, Balanced-Force, and Step-Back techniques. J Endodon 1996;22:123-30.

PURPOSE: To compare the Schneider technique to a new method of measuring canal curvatures, the LAT; and to evaluate CM in curved canals compared to Flex-R files used in BF and SB techniques.

M&M: 75 mesial canals in 53 human man 1st and 2nd molars were used. Canals with curvatures $\geq 15^\circ$ as determined by Schneider's method (SM) were ordered according to curvature and randomly divided into 3 groups: group 1, CM; group 2, BF; group 3, SB. WL was determined with K-Flex files and CM rotaries were used to instrument the coronal and middle thirds. Canal curvatures were determined using SM and the long-axis technique (LAT). Canals in each group were instrumented according to the technique used in that group and final instrumentation radiographs were taken; these were compared with the preinstrumentation radiographs to evaluate the different curvature measurement techniques, the effect of rotary instruments on curvature, and the degree of straightening in each canal due to different instrumentation techniques. Total instrumentation time was recorded for each canal. Postinstrumentation cross-sections of the roots were made at 1-, 3-, and 5-mm levels from the apex to determine minimum remaining dentin/cementum thickness M and D to the canal borders, greatest M-D canal diameter, and postinstrumentation canal shape.

RESULTS: Change in canal curvature from preop to postop showed a loss of curvature for all groups (SM), with the difference between CM and SB significant. Use of LAT showed a curvature loss with CM and BF but not SB; differences were significant for CM vs. BF and SB. Change in canal curvature due to instrumentation for all groups combined showed a mean loss of -6.19° for the SM and -2.85° for the LAT method (stat sig). ANOVA showed a significant difference for BF vs. CM and SB in instrumentation time (BF averaged the least time). None of the techniques resulted in measurable canal transportation. At the 1-mm level, BF had sig larger postinstrumentation canal diameters than CM or SB; at 3 mm, a similar situation was seen; at 5 mm, BF again had sig larger diameters than either CM or SB. At the 1-mm level, no differences in canal shape were seen among the 3 groups; at 3 mm, CM produced sig rounder canals; at the 5-mm level, BF was sig different from SB (rounder). Four CM instruments and one Flex-R used with BF separated during instrumentation, none of which were retrievable.

C&C: Differences in preoperative angulations, angulation after rotary instrumentation, postinstrumentation angulations, and net angulation changes differed for the 3 instrumentation techniques whether measured by SM or by LAT. The LAT is designed to measure the apical curvature more accurately, so it isn't affected by rotary instrumentation coronally. The SB technique consistently showed the least amount of curvature loss, while the CM showed the most curvature loss, which was surprising. There were no sig differences between techniques in minimum remaining M and D root structure after instrumentation or in degree of canal transportation. Canals were instrumented to #40 CM, #30 SB (Flex-R), and #40 BF (Flex-R), which probably explains the lack of serious canal straightening, zipping, or transportation in this study.

An in vitro comparison of the Excalibur handpiece and hand instrumentation in curved root canals

Cheung GSP, Chan AWK. An in vitro comparison of the Excalibur handpiece and hand instrumentation in curved root canals. J Endodon 1996;22:131-4.

PURPOSE: To compare the effects of automated instrumentation using the Excalibur handpiece and hand instrumentation using the step-down technique on the final shape of curved root canals.

M&M: 24 similar canals (mean canal curvature of 24°) from 18 extracted, mandibular molars were randomly divided into two instrumentation groups. All teeth were embedded in casting resin, within a steel mold, and horizontally sectioned at their apical, middle and coronal levels. Canal shapes were image-analyzed pre- and post-preparation. Instrumentation to within 1 mm of the apical foramen was done by either a step-down technique using K-files (group A), or by the Excalibur handpiece, a vibratory, subsonic instrument (group B). All were enlarged to a size of #25 at the apical terminus. The area of dentin removed, amount of canal transportation, and the minimum canal thickness were determined and compared between pre- and post-preparation groups.

RESULTS: In general, more tooth structure was removed coronally; the two techniques removed similar areas of dentin at all 3 levels. The Excalibur group consistently demonstrated greater transportation (toward the outer curve at the apex, and furcally at middle and coronal levels), but the difference was not significant. Excalibur instrumentation produced thinner dentin walls mesially at the apical levels, and furcally at the middle and coronal levels; again, the difference between techniques was not significantly different. 4 strip perforations occurred in the Excalibur group, whereas none occurred in the manual group.

C&C: Apparently, the Excalibur system cannot remain centered within canals, and rather predictably straightens out curvature - each of these tendencies are clear violations of most endodontists' goals of canal preparation.

March 1996

Christopher F. Bates

New directions in surgical endodontics: immediate implantation into an extraction socket

Pecora G, Andreana S, Covani U, De Leonardis D, Schifferle RE. New directions in surgical endodontics: immediate implantation into an extraction socket. J Endodon 1996;22:135-9.

PURPOSE: To evaluate retrospectively the role of immediate implant placement as an alternative treatment to extraction during endo surgery.

M&M: 32 teeth from 31 patients were treated with S RCT to determine the prognosis, ie exploratory surgery. Extractions were necessary due to: VRF, horizontal root fracture, root perforation, or combined perio-endo involvement. Following extraction, the apical part of the sockets was prepared to receive the implants. An e-PTFE membrane (Gore-Tex) was used in 10 cases. No osseous grafts were used. An antibiotic (bacampicillin) and Orudis were prescribed postop, as well as 0.12% chlorhexidine mouthwash. Gore-Tex membranes were removed in 4-6 months at the 2nd stage surgery, except for 4 cases of exposed membranes, which were removed after 6 wk (2) and 8-9 wks (2). Twenty-five implants received single-unit crowns, while 7 served as FPD abutments.

RESULTS: All implants successfully integrated except for one which abscessed (the patient was a heavy smoker). Implants in this study were in function ranging from 3 months to 34 months, with a mean of 16.3 months. Postop radiographic evaluation revealed no evidence of bone loss > 1.5 mm.

C&C: This study shows the possible indications for use of endosseous implants when endodontically treated teeth require extraction, often diagnosed only at time of surgery. Immediate implant placement may preserve socket bone height and width; implant placement immediately following extraction allows for placement in the natural long axis of the tooth (assuming it was in good alignment), making orientation easier; guided tissue membranes can possibly be used to enhance bony architecture. Difficulty in obtaining primary soft tissue closure over the implant and membrane, if used, may create problems. At least in the cases presented here (do these represent all of their treated cases?), immediate implant placement following extraction appears to be a viable treatment alternative for the endodontist.

March 1996

Michael Hall

Blood mercury levels with amalgam retroseals: a longitudinal study

Skoner JR, Wallace JA, Fochtman F, Moore PA, Zullo T, Hoffman RD. Blood mercury levels with amalgam retroseals: a longitudinal study. J Endodon 1996;22:140-1.

PURPOSE: To determine and compare pre- and post-operative blood mercury levels in humans, following placement of freshly mixed amalgam root-end fillings.

M&M: Blood samples were drawn on 10 patients at 7 d before and immediately before a single-root-end surgical procedure, using an amalgam (zinc-free Tytin) filling. Post-operative blood draws were done at 7- and 30-d intervals following surgery. At the end of the study, all samples were blindly analyzed for mercury content using cold-vapor atomic absorption spectrophotometry.

RESULTS: Mean blood mercury levels ranged from 3.74-3.82 ng/ml; no statistically significant increase in blood mercury was detected at 7 and 30 d after placement of an amalgam root-end filling, as compared with pre-operative levels. No patterns of change were observed.

C&C: These findings should relieve the patients and practitioners who feel concern regarding mercury absorption from fresh amalgams which have been placed into surgical sites. It would also be interesting to know the results of a sensitive blood mercury analysis during short intervals in the *immediate* post-placement period.

March 1996

Christopher F. Bates

Osteoblastoma in the anterior maxilla mimicking periapical pathosis of odontogenic origin

Ribera MJ. Osteoblastoma in the anterior maxilla mimicking periapical pathosis of odontogenic origin. J Endodon 1996;22:142-4.

PURPOSE: To present a case of osteoblastoma in the anterior maxilla.

CASE REPORT: A 69-yr-old male presented with a 6-yr history of spontaneous throbbing pain originating from #7 and radiating to the right temporal and frontal areas, and to the opposite canine area. Since #7 was percussion sensitive and a radiolucency was present, the patient's general dentist performed RCT with Ca(OH)₂ placement, despite diagnosis of pulpal vitality. Predictably, the patient's symptoms did not resolve and he was referred to graduate endo. Exam revealed palatal mucosa tender to palpation; there was no cortical bone expansion; #7 was percussion sensitive. The periapical radiolucency was diffuse and did not appear to involve the apices of #7 or #8. RCT was completed on #7 and the patient returned for exploratory surgery in 2 wks, at which time a palatal flap was reflected, revealing a loculated osseous cavity filled with soft tissue which crossed the palatal midline. The lesion was curetted and submitted for biopsy. Post op course was uneventful. Pathological examination determined a diagnosis of osteoblastoma.

C&C: This case represented a rare occurrence of benign osteoblastoma of the anterior maxilla which mimicked a periapical lesion. Vertically angled radiographs showed the lesion to be unrelated to any teeth and indicated a palatal location. The fact that the apex of #7 may have been closer palatally than that of #8 may have accounted for the persistent percussion tenderness of #7. Osteoblastoma must be differentiated from other bone-producing lesions, including osteoid osteoma, cementoblastoma, ossifying fibroma, fibrous dysplasia, and osteosarcoma. Osteoblastomas rarely exhibit aggressive behavior or sarcomatous changes, with no malignant transformations of jaw osteoblastomas reported. Although extremely rare in this location, a differential including benign osteoblastoma must be considered when considering diagnosis of lesions of nonodontogenic origin in the anterior maxilla.

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Michael Hall

Ossifying fibroma as a mixed radiolucent-radiopaque periapical lesion

Piattelli A. Ossifying fibroma as a mixed radiolucent-radiopaque periapical lesion. J Endodon 1996;22:145-6.

CASE REPORT: A 37-yr-old female was evaluated for a radiolucent lesion at the periapex of her mandibular left 1st premolar. The 1 cm lesion was unilocular, had well-defined margins, was primarily radiolucent, and was not associated with root resorption. The patient was asymptomatic, and the overlying mucosa was clinically normal. The lesion was surgically excised, in conjunction with root-end resection and amalgam filling procedures. Histologically, the specimen exhibited spicules of bone, lined by an osteoblast rim, which were immersed in a fibrous stroma. Bony spicules were predominantly of the woven type, with a partial transformation to lamellar bone in the periphery. The diagnosis was ossifying fibroma.

DISCUSSION: The ossifying fibroma is a benign, osteogenic neoplasm consisting of fibrous tissue containing varying amounts of mineralized material resembling bone or cementum. The average age at diagnosis is 36 yrs, the female:male ratio is 5:1, the mandible is affected in 89% of cases, and the molar region is where most lesions arise. Clinically, the ossifying fibroma is sharply defined, tends to expand the bone, may cause root divergence, and is typically unilocular. Treatment should include early excision, because of its potential for extensive growth and fair recurrence rate.

C&C: Many fibroosseous lesions of the jaws will have a radiolucent or a mixed radiolucent-radiopaque appearance, and will be confused with the more common periapical granuloma or radicular cyst. A thorough diagnostic work-up should help to separate pulpal from non-pulpal pathological processes.

March 1996

Christopher F. Bates

Subpontic hyperostosis

Cailleteau JG. Subpontic hyperostosis. J Endodon 1996;22:147-9.

PURPOSE: To present two cases of subpontic hyperostosis.

CASE REPORTS: **Case 1.** Examination of a 64-yr-old Asian male referred for RCT #9 revealed an exostosis on the buccal aspect opposite the pontic of FPD #29-31. The mass had slowly enlarged over the yrs while remaining asymptomatic, the patient's chief complaint being that he could not clean under the pontic anymore. Teeth #29 and and 31 were asymptomatic and pulps tested vital. Clinical diagnosis of subpontic hyperostosis was made. **Case 2.** A 79-yr-old female presented with multiple defective restorations. She had two FPDs, replacing #19 and #30. A panograph revealed the presence of bilateral subpontic hyperostoses, which were asymptomatic.

DISCUSSION: The total number of subpontic hyperostosis cases reported now totals 35. The etiology of this condition remains unknown, but several factors, including mechanical functional stresses, genetic predisposition, chronic inflammation, and infection, have been suggested as possible causes that could result in an imbalance in the osteoclastic and osteoblastic processes leading to increased bone formation. If necessary, treatment involves surgical excision.

C&C: The endodontist should be aware of this condition, if for no other reason than it's incidental finding during examination or due to it's possible interference with flap design and periapical surgery access.

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Michael Hall